UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

Refer to:
2003/00364

March 15, 2004

Lawrence C. Evans
Chief, Regulatory Branch
Department of the Army
Portland District, Corps of Engineers
PO Box 2946
Portland, OR 97208-2946

Re: Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation on the LTM, Inc. Instream Sand and Gravel Mining Project, Umpqua River, Douglas County, Oregon (Corps No. 200200828)

Dear Mr. Evans:

Enclosed is our essential fish habitat (EFH) consultation, dated March 8, 2004, prepared by NOAA's National Marine Fisheries Service (NOAA Fisheries) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and its implementing regulations (50 CFR Part 600) on the effects of issuing a permit under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act for the LTM, Inc., Instream Sand and Gravel Mining Project, Douglas County, Oregon.

As required by section 305(b)(4)(A) of the MSA, our consultation includes conservation recommendations that NOAA Fisheries believes will avoid, minimize, mitigate, or otherwise offset adverse effects on EFH resulting from the proposed action. As described in the enclosed consultation, 305(b)(4)(B) of the MSA requires that a Federal action agency must provide a detailed response in writing within 30 days after receiving an EFH conservation recommendation.

Please direct any comments you may have regarding this consultation to Chuck Wheeler, at 541.957.3379.

Sincerely,

For Michael R Crouse

D. Robert Lohn
Regional Administrator

cc: Robert Vaughn, LTM, Inc.
Teena Monical, USCOE
Yvonne Valette, USEPA
Janine Castro, USFWS
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Magnuson-Stevens Fishery Conservation and Management Act
Essential Fish Habitat Consultation

LTM, Inc. Instream Sand and Gravel Mining Project,
Umpqua River, Douglas County, Oregon
(Corps No. 200200828)

Agency: U.S. Army Corps of Engineers

Consultation Conducted By: National Marine Fisheries Service, Northwest Region

Date Issued: March 15, 2004

Issued by: for Michael R Crouse
D. Robert Lohn
Regional Administrator

Refer to: **2003/00364**

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1. INTRODUCTION

1.1 Project Background

On March 18, 2003, NOAA's National Marine Fisheries Service (NOAA Fisheries) received a letter from the Portland District of the U.S. Army Corps of Engineers (Corps) requesting formal consultation on the effects of issuing a permit under section 10 of the Rivers and Harbors Act and section 404 of the Clean Water Act. The request was made pursuant to sections 7(a)(2) of the Endangered Species Act (ESA) and 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The proposed permit would authorize LTM, Inc. (LTM), the permit applicant, to mine up to 400,000 cubic yards (CY) of sand and gravel annually for a total of 2.4 million CY over a six-year period. The material would be removed from the bed of the Umpqua River, between river miles (RM) 18 and 25, using a barge-mounted clamshell dredge and placed on the barge for initial processing. The dredged material would be washed and sorted onsite, off-loaded to another barge, and transported daily to land-based facilities for final processing and sale. The slurry from the wash plant would be discharged back into the river from a pipe placed below the stream surface. The mining would occur between river miles (RM) 18 and 25, in Douglas County, Oregon. Besides describing the proposed operation and its likely effects on aquatic resources, the Corps found that instream mining is likely to adversely affect Oregon Coast (OC) coho salmon (*Oncorhynchus kisutch*), a species previously listed under the ESA, and its designated essential fish habitat (EFH).

Gravel has been mined in the proposed action area since 1918. LTM renovated the barge and monitoring equipment in 2002, but has not mined any sand and gravel in the proposed action area since the previous Corps permit expired on December 31, 2002.

1.2 Consultation History

A draft biological assessment (BA) for the proposed sand and gravel mining operation considered in this consultation was prepared by LTM and sent to the Corps and NOAA Fisheries during the week of February 3, 2003. An initial meeting between the Corps, LTM and NOAA Fisheries took place on February 13, 2003, at the Corps' Eugene Field Office. The purpose of this meeting was to review the BA and the informational needs of NOAA Fisheries, and to discuss the consultation process. Following this meeting, on February 21, 2003, NOAA Fisheries sent a letter to LTM asking for clarifications of the BA and requesting further information about project design features. LTM responded with a letter on March 1, 2003. NOAA Fisheries received a new BA from the Corps on March 20, 2003, along with a written request initiating formal consultation.

NOAA Fisheries prepared a letter under the authority of the Fish and Wildlife Coordination Act (48 stat. 401, as amended; 16 USC 661 *et seq.*) on March 26, 2003, recommending that the Corps deny the CWA permit application. NOAA Fisheries cited the probable adverse effects of instream gravel mining, the lack of mitigation, and the lack of an analysis of practical alternatives as the basis for these recommendations.

On June 26, 2003, a conference call was held between COE, LTM, and NOAA Fisheries. The primary topic of discussion was identification of the information and analyses necessary to evaluate the effects of the proposed mining on channel morphology, sediment transport processes, and listed species in the project area. LTM hosted NOAA Fisheries staff on a field trip to the action area and processing equipment on July 2, 2003. Some participants cruised the shorelines to familiarize themselves with the action area, others went to the processing barge to see how it is operated.

On July 15, 2003, NOAA Fisheries met with LTM in Portland to discuss the ongoing consultation, and provided a set of suggested conservation practices to help avoid or minimize the adverse effects of the proposed mining operations. At this time, LTM delivered a letter titled "List of Conditions Acceptable to LTM." At this time, the proposed annual dredging volumes were reduced from 400,000 CY to 181,000 CY of sand and gravel; the Corps accepted this list of modifications to the application as the proposed action. The U.S. Fish and Wildlife Service (USFWS) met with the applicant and NOAA Fisheries on July 28, 2003, after receiving documents shortly before the meeting related to the proposed modifications in the "Response of Applicant to Public Comments." On August 15, 2003, NOAA Fisheries, USFWS, and the Corps discussed the modified proposal with several state agencies including, the Oregon Department of Fish and Wildlife (ODFW), Oregon Division of State Lands (ODSL), and Oregon Department of Environmental Quality (ODEQ).

A draft biological opinion and EFH consultation for the effects of proposed mining was transmitted to the Corps on October 27, 2003. In that draft opinion, NOAA Fisheries determined that, based on available information, the LTM, Inc. sand and gravel mining operation in the Umpqua River, as proposed, was likely to jeopardize the continued existence of OC coho salmon and adversely affect EFH designated for groundfish, coastal pelagics, and Pacific salmon. Pursuant to section 7(b)(3)(A) of the ESA, NOAA Fisheries included reasonable and prudent alternatives in the draft opinion that NOAA Fisheries believed would not jeopardize OC coho salmon, and reasonable and prudent measures with nondiscretionary terms and conditions that NOAA Fisheries believed were necessary to minimize incidental take associated with this action. Further, the EFH consultation included conservation recommendations that NOAA Fisheries believed were necessary to minimize those adverse effects.

On February 24, 2004, the Ninth Circuit Court of Appeals issued an ruling in the *Alsea Valley Alliance v. Department of Commerce* case that dissolved a previous stay of the September 12, 2001, U.S. District Court order setting aside the listing of OC coho salmon. As a result of OC coho salmon no longer being protected under the ESA, the draft biological opinion has not been completed, and instead this EFH consultation concludes NOAA Fisheries' review of this Federal action at this time.

2. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

2.1 EFH Background

The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-297), requires the inclusion of EFH descriptions in Federal fishery management plans. In addition, the MSA requires Federal agencies to consult with NOAA Fisheries on activities that may adversely affect EFH.

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting the definition of essential fish habitat, "waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate. "Substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities. "Necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50CFR600.110).

Section 305(b) of the MSA (16 U.S.C. 1855(b)) requires that:

- Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH;

- NOAA Fisheries shall provide conservation recommendations for any Federal or state activity that may adversely affect EFH;

- Federal agencies shall, within 30 days after receiving conservation recommendations from NOAA Fisheries, provide a detailed response in writing to NOAA Fisheries regarding the conservation recommendations. The response shall include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the conservation recommendations of NOAA Fisheries, the Federal agency shall explain its reasons for not following the recommendations.

The MSA requires consultation for all actions that may adversely affect EFH, and does not distinguish between actions within EFH and actions outside EFH. Any reasonable attempt to encourage the conservation of EFH must take into account actions that occur outside EFH, such as upstream and upslope activities, that may have an adverse effect on EFH.

Therefore, EFH consultation with NOAA Fisheries is required by Federal agencies undertaking, permitting or funding activities that may adversely affect EFH, regardless of its location.

2.2 Identification of EFH

Pursuant to the MSA, the Pacific Fisheries Management Council (PFMC) has designated EFH for federally-managed fisheries within the waters of Washington, Oregon, and California. Designated EFH for groundfish and coastal pelagic species encompasses all waters from the mean high water line, and upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon and California, seaward to the boundary of the U.S. exclusive economic zone (370.4 km) (PFMC 1998a, 1998b). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other waterbodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC 1999), and longstanding, naturally-impassable barriers (*i.e.*, natural waterfalls in existence for several hundred years) (PFMC 1999). In estuarine and marine areas, designated salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (370.4 km) offshore of Washington, Oregon, and California north of Point Conception to the Canadian border (PFMC 1999).

Detailed descriptions and identifications of EFH are contained in the fishery management plans for groundfish (PFMC 1998a), coastal pelagic species (PFMC 1998b), and Pacific salmon (PFMC 1999). Casillas *et al.* (1998) provides additional detail on the groundfish EFH habitat complexes. Assessment of the potential adverse effects to these species' EFH from the proposed action is based, in part, on these descriptions and on information provided by the Corps of Engineers (COE) and the ODFW.

The project area includes habitat which has been designated as EFH for various life stages of 25 species of groundfish and coastal pelagics, and two species of Pacific salmon (Table 1).

Table 1. Species with designated EFH in the Estuarine EFH Composite in the State of Oregon.

Groundfish Species	
Leopard Shark (southern OR only)	*Triakis semifasciata*
Soupfin Shark	*Galeorhinus zyopterus*
Spiny Dogfish	*Squalus acanthias*
California Skate	*Raja inornata*
Spotted Ratfish	*Hydrolagus colliei*
Lingcod	*Ophiodon elongatus*
Cabezon	*Scorpaenichthys marmoratus*
Kelp Greenling	*Hexagrammos decagrammus*
Pacific Cod	*Gadus macrocephalus*
Pacific Whiting (Hake)	*Merluccius productus*
Black Rockfish	*Sebastes maliger*
Bocaccio	*Sebastes paucispinis*
Brown Rockfish	*Sebastes auriculatus*
Copper Rockfish	*Sebastes caurinus*
Quillback Rockfish	*Sebastes maliger*
English Sole	*Pleuronectes vetulus*
Pacific Sanddab	*Citharichthys sordidus*
Rex Sole	*Glyptocephalus zachirus*
Rock Sole	*Lepidopsetta bilineata*
Starry Flounder	*Platichthys stellatus*
Coastal Pelagic Species	
Pacific Sardine	*Sardinops sagax*
Pacific (Chub) Mackerel	*Scomber japonicus*
Northern Anchovy	*Engraulis mordax*
Jack Mackerel	*Trachurus symmetricus*
California Market Squid	*Loligo opalescens*
Pacific Salmon Species	
Chinook Salmon	*Oncorhyncus tshawytcha*
Coho Salmon	*Oncorhyncus kisutch*

2.3 Proposed Action

As described by LTM on July 15, 2003, the proposed action is to mine and wash 1.1 million CY of sand and gravel in the Umpqua River between RM 19 and 25. The mining would take place over a six-year period at a rate of 181,000 CY per year. The sand and gravel would be excavated from the river channel using a barge-mounted clamshell dredge between the hours of 7:00 a.m. and 10:00 p.m. up to six days a week, and continue year-round without restriction, including seasons when vulnerable life stages of OC coho salmon are migrating and rearing in the action area.

Channel depths after mining would not exceed 40 feet below National Geodetic Vertical Datum (NGVD),[1] and would average 35 feet below NGVD. Bedrock shorelines would have a 50-foot setback, and alluvial shorelines and islands would have a minimum setback of 150 feet. At the confluences of Charlotte Creek, Franklin Creek, Harvey Creek, Indian Charlie Creek, Mill Creek, and Luder Creek, LTM would leave setbacks of 200 feet from the shoreline, and 300 feet upstream and 300 feet downstream. After mining, the channel side slope would range from 0.5:1 (horizontal to vertical) near bedrock shores to 3:1 near alluvial shores.

The clamshell dredge would scoop and load sand and gravel onto a barge where it would be washed and sorted. Wash water would be drawn from the Umpqua River at a rate of 600 gallons per minute. Intake pipe screens would have 3/32-inch mesh size. The wash water would be discharged below the river surface at a depth of 5-15 feet. A cyclone separator would be installed on the product washing barge to release only sediments that would pass through a 200 mesh sieve (0.0029-inch). The turbidity monitoring program would be expanded to include salinity and temperature measurements to evaluate seasonal salinity changes within the project area. The measurements would be made along fixed, cross-section transects established between RM 19 and RM 25.

Actions interrelated with the mining include the transfer of sand and gravel from the clamshell to the processing barge where it is washed, then to a transport barge that moves the sand and gravel each day to onshore facilities in Reedsport at approximately RM 10. There, the sand and gravel are separated, part of the gravel is crushed, and all products are stored until sold. The onshore facility consists of several buildings and a storage yard covering 17 acres of land within the Umpqua River floodplain.

2.4 Description of the Action Area

The action area include those areas to be affected directly or indirectly by the Federal action and not merely the immediate area (project area) involved in the proposed action. The direct effects occur at or beyond the project site based on the potential for upstream or downstream effects (*e.g.*, alteration of channel, loss of sediment supply to downstream gravel bars, alteration of stream channel morphology, increases in total suspended solids (TSS), and displacement, injury to, or killing of coho salmon) in the action area. Indirect effects may occur at or beyond the project site when the proposed action leads to additional activities that contribute to aquatic habitat degradation. For this consultation, the action area is the Umpqua River from RM 0 to RM 27. The streambed of the Umpqua River is alluvial up to RM 27, where it becomes bedrock. Gravel excavation could initiate headcutting that would affect the alluvial streambed upstream (OWRRI 1995). Taking gravel out of the system means that less gravel would be available to

[1] NGVD, also called 'NGVD 29' and the '1929 mean sea level datum,' is a vertical geodetic datum established by the National Ocean Service. This datum is calculated by averaging the sea level over many years at tide stations along the coasts of the U.S. and Canada. Because NGVD is an average, it does not represent the local mean sea level for the action area, or for any other particular place.

downstream areas. According to Ratti (1979), winter floods can deposit sediments and gravels as far as the mouth of the estuary, but high flows tend to scour the navigational channel.

Since gravel mining can initiate headcutting, the action area also extends into tributaries of the Umpqua River near the project site. This includes the tidally-influenced portions of Harvey Creek (0.8 miles), Indian Charlie Creek (0.1 miles), Franklin Creek (0.4 miles), Mill Creek (0.4 miles), Charlotte Creek (0.2 miles) and Luder Creek (0.2 miles). The action area also includes the channel migration zones of these waterways.

The culverts where Highway 138 crosses Charlotte Creek and Luder Creek control the stream grade for these two streams. This eliminates the potential for effects to travel from the Umpqua River upstream into Charlotte Creek and Luder Creek. However, these perched culverts are scheduled to be replaced with bridges in 2005, within the time frame of this proposed action. In the cases of Charlotte Creek and Luder Creek, the action area extends up to the point that should become the tidally-influenced channel once the culverts are replaced. The action area includes habitats that have been designated as EFH for various life-history stages of 20 species of groundfish, five coastal pelagic species, and two species of Pacific salmon (Table 3).

2.5 Analysis of Effects

The proposed action consists of mining sand and gravel from the river channel using a clamshell dredge. The dredge will be operated from a barge that will be moved between mining areas. Actions that are interrelated and interdependent with the proposed action include transferring the sand and gravel to a transport barge, moving the sand and gravel to the upland processing area near Reedsport at RM 10, then processing the material for sale and off-site use. Together, these actions will produce a sequence of direct effects that will begin immediately at the project site, and will eventually be felt as a chain of indirect effects that will occur later in time and spread across a much larger upstream and downstream area. The most important habitat effects would be channel modification, altered sediment transport balance, water quality degradation, and loss of riparian function. The most important biological effects would be reduction of macroinvertebrate production, pollution effects, and impairment of essential biological behaviors related to rearing, migrating, feeding, and sheltering, in the action area.

The effects analysis presented in this section is based on information in the BA and supplementary material, and the effects summarized in NOAA Fisheries (1996) and Cluer (2003). Each of these documents were developed using a combination of analyses of existing data and best professional scientific judgement. Together with the literature cited therein, they provide a comprehensive review of the effects of instream gravel mining on habitat conditions necessary to sustain all life stages of anadromous fish and aquatic habitats.

<u>Channel Modification</u>
The proposed mining volume of 181,000 CY per year exceeds the average estimated bedload recruitment 73,000 CY per year (USFWS 2003) by 108,000 CY per year. Comparing records of present thalweg depths and COE soundings from 1921 show that the bed is getting lower in the

vicinity of Brandy Bar Island (USACE 1921). The difference is approximately 20 feet, or an average of one foot per four-year period. As the thalweg is lowered, areas nearby become more vulnerable to erosion. This pattern is consistent with channel adjustments caused by instream mining (Kondolf 2002), a problem that becomes worse as mining levels exceed supply.

Three cross-sections in the vicinity of two spawning tributaries were provided in exhibit G of the LTM comments dated December 8, 2003. The cross-section for RM 20.8 shows 2002 pre-dredging depths of -30 feet on the south side and -20 feet on the north side. In the middle, the bed depth averages around -15 feet. An area of aggregate removal is designated as approximately 300 feet wide and ranging from 0 to 10 feet in height. The area shown is upstream from Brandy Bar Island, and falls approximately1500 feet downstream of the Franklin Creek confluence on the north bank. This is prime shallow water habitat with the confluence providing nutrients, ideally an area in which to minimize disturbance of rearing habitat, or spawners holding before moving into the tributary. If the mining area along the south side is dug with a trench up to 10 feet deep as shown in the cross-section, the change in river bed should be monitored for its effect on the adjacent habitat area of the channel. Similarly the cross-section provided for the area near RM 19.2, below the Harvey Creek confluence on the north bank, shows depths of -10 feet or less. This suggests that without deepening the thalweg, the remaining area would deepened to -10 feet. The river is 1600 feet wide at this point, and a width of at least 1000 feet would be mined with setbacks of 150 feet on each side.

Channel deepening reduces the available low velocity, shallow water habitats, which appear to be especially important to salmon in the estuary (Bottom and Jones1990, Dawley *et al.*, 1986), by providing areas for refuge and feeding. McMahon and Holtby (1992) found coho smolts sought cover as they migrated through the estuary. Gravel mining results in a deeper and less complex streambed which would not provide refuge areas like shallow complex habitat. Structural and biological features of estuarine habitats that provide refugia from predators and off-channel areas protected from strong tidal and river currents are important to salmon survival. Important features that can minimize effects of predators and strong flows include: (1) Complex dendritic tidal channel systems and other landforms (islands, peninsulas, *etc.*); (2) wood, emergent vegetation, or other structural components; and (3) connections between mainstem channels and floodplains. Channel deepening alters salmonid food webs by eliminating shallow water estuarine habitat, where food webs are based on emergent marsh vegetation and infauna (Bottom and Jones, 1990; Dawley *et al.*, 1986). These food webs are more likely to directly support salmonid productivity than ones in large open channels (Bottom *et al.*, 1984; Salo, 1991). Holtby *et al.* (1990) states that rapid growth during estuary rearing may reduce vulnerability to nearshore predators, which are believed to be a major source of ocean mortality for coho salmon.

Deep gravel deposits and complex bedforms induce hyporheic flows that cool stream temperatures. Removing gravel and filling the interstitial spaces with silt reduces hyporheic flow and causes the loss of this cool water refugia by eliminating or reducing cool water flow. Since stream temperatures during the summer limit the number of rearing juvenile OC coho salmon in the action area, any reduction in cool water will reduce those numbers. This is due to the individuals that are present likely utilize thermal refuges where cool interstitial flows come out of the substrate.

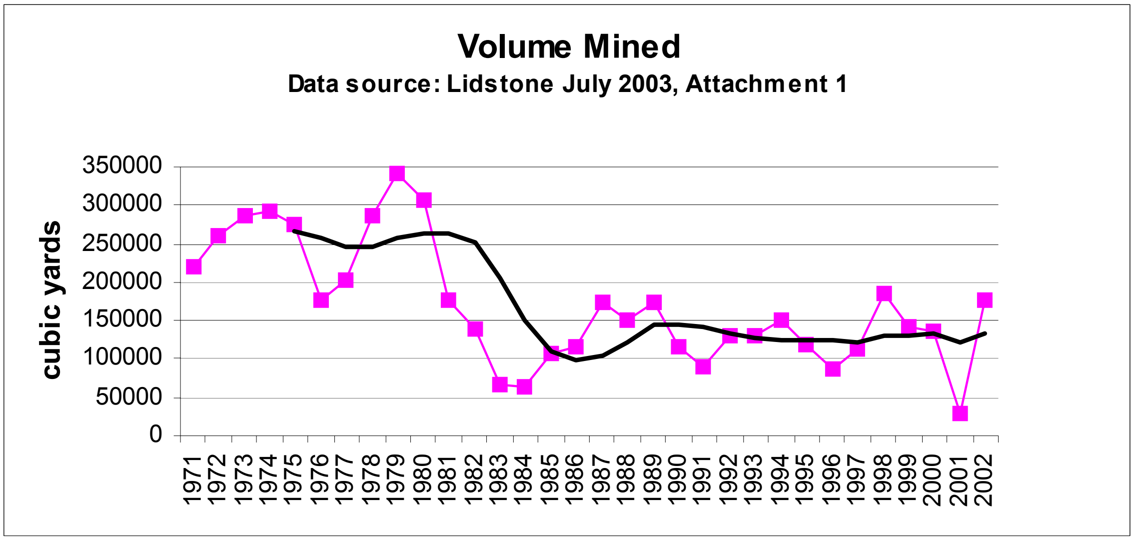
Altered Sediment Transport Balance

Excavation of the river bed also alters the relationship between sediment load and shear stress forces and increases bank and channel erosion. This not only disrupts channel form, it also disrupts the processes of channel formation and habitat development (Lagasse *et al.* 1980, Newport and Moyer 1974, Waters 1995). At the upstream end of the excavation, a knickpoint forms where higher velocity at the locally steeper gradient starts a 'headcut' that migrates upstream and may enter tributaries (Kondolf 1997, Kondolf *et al.* 2002). As the mined area traps bedload sediment, the flows retain the capacity to transport sediment downstream but require a source of replacement sediment to establish a new equilibrium. These "hungry" flows lead to erosion and an incised streambed below the excavation area (Kondolf 1997, Kondolf *et al.* 2002).

At high flows the complex streambed is replaced with trench-like extensions from the excavation area, without the roughness elements to provide velocity refugia to upstream and downstream migrants. Pool-riffle complexes are modified or lost from reaches with extensive changes in channel profile. When the volume mined exceeds the recruitment level, the dynamic formation of bars and islands is reduced due to the lack of material.

Flows in the vicinity and downstream of the mined area can erode channel features, such as shoals, bars, and islands. The vegetation destroyed on the mid-channel Echo Island at RM 18 in the 1964 flood may not have been unusual, given the magnitude of the flood flows. However, the complete disappearance of the shoals and the island, and the lack of rebuilding via depositional processes, are indicative of sediment-starved waters. Similar reduction in shallow water habitat area is seen at Brandy Bar Island, the shoal upstream, and the nearby alluvial mouth of Franklin Creek. USGS cross sections near Franklin Creek show thalweg depths of 30 feet MSL (Oster 1975). Maps prepared by the Corps in 1921 for this same area showed low water soundings no deeper than 11 feet, with shallower depths of 3 feet downstream between Franklin Creek and Brandy Bar Island. The limited recruitment in the area is corroborated by the 25 foot thalweg depths provided by LTM for 2002. Limited recruitment can also be inferred from the declining volumes mined with five-year running averages of annual volumes averaging 169.000 over the whole period, but only 126,000 cubic yards from 1981 to 2002 (Figure 1).

Figure 1. Annual Volumes Mined by Umpqua River Navigation 1971-2002



Water Quality Degradation

Instream gravel mining, including transport by barge, creates a turbidity plume with effects on migrating and rearing fish. Increased turbidity will likely displace fish in the project area and disrupt normal behavior. The direct physical and chemical effects of dredging and spoil disposal activities include increased turbidity and bottom siltation with fine sediments (Darnell 1976, NOAA Fisheries 2002b).

The proposal for onboard sediment washing included discharge of wash water at 15 feet below the water surface, with a proposed additional cyclone separator to capture sand, while releasing fines less than .074 millimeters (0.0029 inches) in the wash water. This fine sediment, placed in suspension by the mining and washing, could settle into areas near the mining operation but will re-mobilize at low flow levels. In the areas where fines settle, interstitial space is decreased. Due to tidal influences extending into tributaries, the fines may increase embeddedness of spawning reaches.

The clamshell digging disturbs the armor layer, and releases sediment as the bucket travels through the water column to the barge surface. Suspended material will redistribute and settle to the bottom, reducing the particle size of surface sediments. Sediment may scour, smother or bury primary producers (diatoms, aquatic vegetation) and consumers (epibenthic organisms) reducing their availability as coho salmon food. Turbidity will reduce light penetration and interfere with photosynthetic production of oxygen. Chronic turbid conditions also reduce the depth that macrophytes may colonize. Extraction during low flow periods suspends fine sediment when concentrations are normally low and the river is less able to assimilate suspended sediment (Weigand 1991).

Collins and Dunne (1990) noted that scoured bed gravels expose underlying substrates, and that pool-riffle structures are destroyed, leaving unsuitable fish habitat. Finer sediment is released, leading to increases in suspended sediment. The modified morphology and reduced overall sediment supply propagate the habitat effects beyond the immediate extraction area. Because sediment 'armors' the bed and stabilizes banks and bars, removing this armor layer causes excessive scour and sediment movement after the mining operation (Lagasse *et al.* 1980; OWRRI, 1995). The more easily transported particles eroded by the 'sediment-starved' water will increase both the background turbidity level and the embeddedness of downstream substrate, while coarsening the scoured areas (Kondolf 1993, Dietrich 1989). Given the tidally-influenced nature of the reach, sediments disturbed by mining activities are likely to settle near the mining area until re-suspended by winter storms.

At moderate levels, turbidity can adversely affect primary and secondary productivity. At high levels, turbidity can injure and kill adult and juvenile fish. Turbidity might also interfere with feeding (Spence *et al.* 1996). Behavioral effects on fish, such as gill flaring and feeding changes, have been observed in response to pulses of suspended sediment (Berg and Northcote 1985). Rivier and Seguier (1985) examined extraction of alluvial material from river beds, and noted the increase in fines silting up the channel, as well as the related effects on fish by the suspended sediment. These effects include problems caused to fish breathing mechanisms and increased abrasions leading to penetration of pathogenic agents due to high concentrations of suspended sediments.

Exposure duration is a critical determinant of the occurrence and magnitude of turbidity caused physical or behavioral turbidity effects (Newcombe and MacDonald 1991, Newcombe and Jensen 1996). Salmonids have evolved in systems that periodically experience short-term pulses (days to weeks) of high suspended sediment loads, often associated with flood events, and are adapted to such seasonal high pulse exposures. Adult and larger juvenile salmonids appear to be little affected by the high concentrations of suspended sediments that occur during storm and snowmelt runoff episodes (Bjornn and Reiser 1991). However, research indicates that chronic exposure can cause physiological stress responses that can increase maintenance energy and reduce feeding and growth (Redding *et al.* 1987, Lloyd 1987, Servizi and Martens 1991). In a meta-analysis and review of 80 published reports of fish responses to suspended sediment in streams and estuaries, Newcombe and Jensen (1996) documented increasing severity of ill effects with increases in dose (concentration multiplied by exposure duration). They used the results to model empirical log-linear equations for different life history stages of salmonids to predict severity of ill effects from exposure concentration and duration. For events between extremes of no effect and 100% mortality, they scored qualitative response data with a semi-quantitative ranking scale of severity ranging from 1 - 3 for behavioral, 4 - 8 for sublethal and 9 - 14 for lethal and paralethal.

One model for juvenile and adult salmonids exposed to sediments from fine to coarse size, provided the following equation:

(1) $\text{Severity} = 1.0642 + .6068 * \log_e(\text{time}) + .7384 * \log_e(\text{concentration})$

where time is in hours and concentration is measured in milligrams of suspended solids per liter (mg SS/L). This would result in a range of severity values with either increasing time or increasing concentration, such as shown for these values:

Duration (hours)	**Concentration** (mg SS/ L)	**Severity**	**Effects description**
1	88	2	Alarm reaction
12	54	5.5	Minor physiological stress (increased coughing or respiration)
36	9400	10.0	0 -20% mortality
96	488	8.4	Major physiological stress (reduced feeding rate or success)

Elevated total suspended solids (TSS) conditions were reported to cause physiological stress, reduce growth, and adversely affect survival. Of key importance in considering the detrimental effects of TSS on fish are the season, frequency and the duration of the exposure. Behavioral avoidance of turbid waters may be one of the most important effects of suspended sediments (Scannell 1988). Salmonids have been observed to move laterally and downstream to avoid turbid plumes (Scannell 1988, Servizi and Martens 1991).

Fish that remain in turbid, or elevated TSS, waters can experience a reduction in predation from piscivorous fish and birds (Gregory and Levings 1998). In systems with intense predation pressure, this provides a beneficial trade-off as enhanced survival at the cost of potential physical effects, like reduced growth. Turbidity levels of about 23 Nephalometric Turbidity Units (NTU) have been found to minimize bird and fish predation risks (Gregory 1993).

Macroinvertebrate Production

Interstitial spaces and aquatic vegetation provide habitat for the invertebrate communities that are a major food source for all age classes of salmon. Macroinvertebrates move, rest, find shelter, and feed on the substrate and vegetation. Stability of the substrate is affected by changes in size, sorting, roundness, and shape (Rice *et al.* 2001). Spatial variations in bed material are reflected by macroinvertebrate responses at various scales.

For substrate-oriented macroinvertebrates, the highest abundance is produced by well-graded mixtures of gravel and cobble, with poorly-graded mixtures of sands and silts or boulders and bedrock producing the lowest abundance (Reiser 1998). In particular, the significant taxonomic groups for salmonid food sources, including orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichopetera (caddisflies), collectively designated EPT organisms, show preferences for small to large-sized gravels rather than coarse or fine sands. Reiser (1998) described studies which showed an association between stonefly abundance and the volume of interstitial space, suggesting excessive deposition of fine sediments can reduce pore space and result in less invertebrate production. Sediment intrusion into interstitial spaces decreases the habitable areas for EPT species (Bjornn *et al.* 1977). Reduced food sources, particularly when combined with higher temperatures, will result in decreased growth rates or reduced survival

(Brett *et al.* 1982, Rich 1987), as fish need higher food intakes to maintain homeostasis at higher temperatures due to reduced conversion efficiencies (Smith and Li 1983).

Brown *et al.* (1998) sampled within an instream gravel mining project, and upstream and downstream, and observed significant alterations in all components of biotic communities, biomass, invertebrates, and fish. The biomass and density of small invertebrates and density of large invertebrates were reduced at smaller, frequently mined sites, and density of fish in pools were reduced at large mines. Brown *et al.* (1998) suggested that the alteration of normal riffle-pool morphology, flow patterns, and fine sediment transport explained the communities' response to the mining disturbance. Rivier and Seguier (1985) found that not only was biomass of benthic invertebrates found to decrease downstream, but the groups represented shifted from the EPT organisms to those suitable to finer material in the substrate, such as Chironomids and Oligochaetes. With macroinvertebrate habitat reduced by fines deposited in interstitial spaces during and after mining and by increased bed depth, macroinvertebrate food sources are reduced, and lower growth rates would be expected. An accompanying reduction or elimination of food, or a change in invertebrate prey species may displace OC coho salmon from rearing habitat. Decreases in growth and consequent decreases in smolt size will result in decreased smolt to adult survival.

Vegetation-oriented macroinvertebrates are affected either by physical destruction of vegetation, turbidity concentrations, or by bed elevation lowering, which reduces the shallow water estuarine habitat where vegetation can grow. Food webs based on vegetation are more likely to directly support salmonid productivity than ones in large open channels (Bottom *et al.*, 1984; Salo, 1991).

<u>Pollution Effects</u>

Operation of the excavator and processing equipment requires the use of fuel, lubricants, and other petroleum products, which, if spilled into the bed or channel or into the riparian zone of a waterbody during construction could injure or kill aquatic organisms. Petroleum-based contaminants (such as fuel, oil, and some hydraulic fluids) contain polycyclic aromatic hydrocarbons (PAHs) which can cause acute toxicity to salmonids at high levels of exposure, and can also cause chronic lethal as well as acute and chronic sublethal effects to aquatic organisms (Neff 1985).

Dredging and excavation activities have the potential to resuspended bedded contaminants or unearth buried contaminants adhered to sediment and soil particles. Discharge of barge water during transit can carry sediments and a variety of contaminants to the riparian area and stream. Once delivered into the waterbody, those contaminants act as new contaminant sources to benthic invertebrates and fish. The suspended, contaminated particles can re-settle onto a new site, affecting a previously undisturbed benthic population, or be taken up directly or indirectly by fish. Upland contained areas can also produce contaminated runoff. To ensure that spills will be prevented, a pollution control plan will be prepared and carried out.

Loss of Riparian Function

Transfer of sand and gravel from barges to onshore facilities and subsequent processing and storage that takes place within the Umpqua River riparian area and floodplain result in loss of riparian function. Associated access roads, buildings, staging areas, and movements of machines and personnel over the action area contribute to these adverse effects. These structures and activities remove riparian vegetation and topsoil, expose deeper soil layers, extend operations into the active channel, and reshape banks as necessary for operational considerations.

To the extent that these areas were providing riparian habitat function, such as delivery of large wood, particulate organic matter or shade to a riparian area and stream, root strength for slope and bank stability, and sediment filtering and nutrient absorption from runoff, maintaining these areas in an unvegetated condition will reduce or eliminate those habitat values (Darnell 1976, Spence *et al.* 1996). Denuded areas lose organic matter and dissolved minerals, such as nitrates and phosphates. Microclimate can become drier and warmer with corresponding increases in wind speed, and soil and water temperature. Water tables and spring flow can be reduced. Loose soil can temporarily accumulate in the processing and storage areas. In dry weather, this soil can be dispersed as dust. In wet weather, loose soil is transported to streams by erosion and runoff, particularly in steep areas. Erosion and runoff increase the supply of soil to lowland drainage areas and eventually to aquatic habitats where they increase water turbidity and sedimentation. This combination of erosion and mineral loss can reduce soil quality and site fertility in riparian and floodplain areas. Concurrent in-water work can compact or dislodge channel sediments, thus increasing turbidity and allowing currents to transport sediment downstream where it is eventually redeposited. Continued operations when the processing and storage sites are saturated can significantly increase the likelihood of severe erosion and contamination.

Use of heavy equipment during processing and storage creates the opportunity for accidental spills of fuel, lubricants, hydraulic fluid and similar contaminants into the riparian zone or water where they can injure or kill aquatic organisms. Discharge of water used for processing, vehicle washing, and other purposes can carry sediments and a variety of contaminants to the riparian area and stream. Similarly, use of treated wood in or over flowing water to build any type of structure in the processing or storage sites can introduce toxic compounds directly into the stream during cutting or abrasion, or by leaching (Poston, 2001). Heavy equipment can also cause soil compaction, thus reducing soil permeability and infiltration. Construction of pavement, buildings, and other permanent soil coverings or structures also reduce site permeability and infiltration. Permeability and infiltration are inversely related to the rate and volume of runoff. During and after wet weather, increased runoff can suspend and transport more sediment to receiving waters. This increases turbidity and stream fertility. Increased runoff also increases the frequency and duration of high stream flows and wetland inundation in processing and storage areas. Higher stream flows increase stream energy that can scour stream bottoms and transport greater sediment loads farther downstream that would otherwise occur. Sediments in the water column reduce light penetration, increase water temperature, and modify water chemistry. Once deposited, sediments can alter the distribution and abundance of important instream habitats, such as pool and riffle areas. During dry weather, the physical effects of increased runoff appear as reduced ground water storage, lowered stream flows, and lowered wetland water levels. The effects of reduced soil permeability and infiltration are most significant in upland areas where runoff processes and the overall storm hydrograph are controlled mainly by groundwater recharge and subsurface flows.

2.5 Summary of Effects

As described above, the proposed action may result in adverse effects to EFH habitat parameters. These adverse effects are:

- Alteration of the Umpqua River channel bed.
- Increased turbidity and settling out of fine sediment onto the streambed.
- Alteration of macrophyte communities.
- Potential exposure to hazardous materials.
- Loss of riparian function.

2.6 Conclusion

NOAA Fisheries concludes that the proposed action will adversely affect EFH for Pacific salmon, groundfish and coastal pelagic species.

2.7 EFH Conservation Recommendations

Pursuant to section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations to Federal agencies regarding actions which may adversely affect EFH. While NOAA Fisheries understands that the conservation measures described in the biological assessment will be implemented, it does not believe that these measures are sufficient to address the adverse impacts to EFH described above. NOAA Fisheries recommends that the Corps implement the following conservation measures to minimize the potential adverse effects to EFH (Hanson, *et al.* 2003).

1. The Corps should avoid adverse effects to EFH from gravel mining in the action area by identifying upland or off-channel (where channel will not be captured) gravel extraction sites as alternatives to sand and gravel mining in EFH, if possible.

2. If operations within EFH cannot be avoided, the Corps should design, manage, and monitor sand and gravel mining operations to minimize potential direct and indirect impacts to EFH, as recommended below. These include, but are not limited to, effects on migratory corridors, foraging and spawning areas, stream/riverbanks, and intertidal areas.

3. The Corps should use the current knowledge of sediment recruitment, stream dynamics, and fish biology to limit the volume sand and gravel removed from the project area to that which the Corps can demonstrate can be removed on a sustainable basis, with minimal adverse effects to EFH. Restricting the volume of mined material so as to not

exceed natural recruitment will ensure the restoration of a positive sediment transport budget and the related processes necessary to produce and sustain channel features and other habitat elements required by Pacific salmon and other EFH species within the action area.

4. The Corps should prevent or minimize the loss and degradation of important aquatic habitats caused by the physical removal of habitat substrate by excluding mining operations from aquatic habitats that are the most valuable for Pacific salmon and groundfish, and the most sensitive to disturbance, including shallow water areas less than 10 feet deep and areas around the mouths of tributary streams that provide productive conditions for salmon and the organisms they require as food.

5. The Corps should reduce the loss and degradation of aquatic habitats by preventing the depth of mined pits from exceeding the thalweg depth, thus reducing the potential for further channel incision that would threaten the most productive habitat areas in the action area and disrupt ecological interactions between the stream and adjacent riparian and floodplain areas.

6. Ths Corps should require the use of all appropriate practicable measures to minimize the generation of sedimentation and turbidity, so as to limit the effects to EFH to the immediate vicinity of the dredging barge.

7. The Corps should prepare and carry out a compensatory mitigation plan, pursuant to the Corps' Regulatory Guidance Letter No. 02-2 (December 24, 2002), to replace aquatic resource functions unavoidably lost or adversely affected by authorized activities. Mitigation may include reestablishment or rehabilitation of natural riparian vegetation and shallow-water habitats in areas of the Umpqua Basin occupied by Pacific salmon and groundfish.

9. The Corps should provide pre- and post-mining surveys of channel morphology throughout the mining area. Also, we would appreciate receiving copies of any written plans for pollution and erosion control, estimated depths of mining activities, sand and gravel volumes, sediment size distribution, turbidity monitoring reports and a summary of pollution and erosion control inspections, including any erosion control failure, contaminant release, and correction efforts.

2.8 Statutory Response Requirement

Pursuant to the MSA (§305(b)(4)(B)) and 50 CFR 600.920(j), Federal agencies are required to provide a detailed written response to NOAA Fisheries' EFH conservation recommendations within 30 days of receipt of these recommendations. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity on EFH. In the case of a response that is inconsistent with the EFH conservation recommendations, the response must explain the reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

2.9 Supplemental Consultation

The COE must reinitiate EFH consultation with NOAA Fisheries if the proposed action is substantially revised in a manner that may adversely affect EFH, or if new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 CFR 600.920(k)).

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